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(21) International Application Number: PCT/CA00/00981

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09/505,732 17 February 2000 (17.02.2000) US

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(75) Inventors/Applicants (*for US only*): BRUN DEL RE, Riccardo [CA/CA]; 1105 Grenon Avenue, Ottawa, Ontario K2B 1A9 (CA). BATKIN, Izmail [CA/CA]; 911G - Elmsmere Road, Gloucester, Ontario K1J 8G4 (CA). YOUNG, Wayne [CA/CA]; 2331 Cotters Cres., Gloucester, Ontario K1V 8X7 (CA).

Published:

— Without international search report and to be republished upon receipt of that report.

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: ELECTRIC FIELD SENSOR

(57) Abstract: An electric field sensor employs a capacitive pick-up electrode in a voltage divider network connected to a body emanating an electric field. The system is relatively insensitive to variations in the separation gap between electrode and body, reducing sensor motion artifacts in the output signal and stabilizing its low frequency response. The pick-up electrode may be positioned at a "stand off" location, spaced from intimate contact with the surface of the body. This is equivalent to providing low level capacitive values for the capacitive coupling between the pick-up electrode and the body whose electric field is to be monitored. Or a series limiting capacitor may be provided in the input stage. Human body-generated electrical signals may be acquired without use of conductive gels and suction-based electrodes, without direct electrical contact to the body, and even through thin layers of clothing.

WO 01/16607 A2

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference CORDL-02.PCT 5041-02	FOR FURTHER ACTION see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
International application No. PCT/CA 00/ 00981	International filing date (day/month/year) 25/08/2000	(Earliest) Priority Date (day/month/year) 26/08/1999
Applicant CORDLESS ANTISTATIC RESEARCH INC. et al.		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 4 sheets.

☒ It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the report

- a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

- b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :

☐ contained in the international application in written form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. ☐ **Certain claims were found unsearchable** (See Box I).

3. ☒ **Unity of invention is lacking** (see Box II).

4. With regard to the **title**,

☐ the text is approved as submitted by the applicant.

☒ the text has been established by this Authority to read as follows:

CAPACITIVE ELECTRIC FIELD SENSOR

5. With regard to the **abstract**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No.

☐ as suggested by the applicant.

☒ because the applicant failed to suggest a figure.

☐ because this figure better characterizes the invention.

1A

☐ None of the figures.

INTERNATIONAL SEARCH REPORT

International Application No

T/CA 00/00981

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A61B5/0408

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 A61B G01D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ, COMPENDEX, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 602 639 A (HOOGENDOORN DIRK ET AL) 29 July 1986 (1986-07-29) column 1, line 52 -column 2, line 15 column 4, line 13-22 column 5, line 10-33; figures 1,5,6	1-6,9, 12,17-19
Y	---	20
X	US 3 880 146 A (EVERETT DONALD B ET AL) 29 April 1975 (1975-04-29) column 4, line 7-18; figures 1,2	7,8
Y	---	20
A	US 3 882 846 A (FLETCHER JAMES C ADMINISTRATOR ET AL) 13 May 1975 (1975-05-13) abstract; figures 4-6 column 4, line 52-57 ---	1,9, 11-17
	--- -/--	

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents:

- *A* document defining the general state of the art which is not considered to be of particular relevance
- *E* earlier document but published on or after the international filing date
- *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- *O* document referring to an oral disclosure, use, exhibition or other means
- *P* document published prior to the international filing date but later than the priority date claimed

- *T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- *X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- * & * document member of the same patent family

Date of the actual completion of the international search

26 February 2001

Date of mailing of the international search report

06/03/2001

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
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Authorized officer

Jonsson, P.O.

INTERNATIONAL SEARCH REPORT

International Application No

PCT/CA 00/00981

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	<p>GB 1 442 296 A (SECR DEFENCE) 14 July 1976 (1976-07-14) page 2, line 33-51 page 2, line 126-130; claim 1 -----</p>	<p>1, 14, 15, 17</p>

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

T/CA 00/00981

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 4602639	A	29-07-1986	LU 84250 A AT 31869 T DE 3375279 D EP 0098413 A	22-03-1984 15-01-1988 18-02-1988 18-01-1984
US 3880146	A	29-04-1975	NONE	
US 3882846	A	13-05-1975	NONE	
GB 1442296	A	14-07-1976	NONE	

PATENT COOPERATION TREATY

PCT

From the INTERNATIONAL BUREAU

NOTIFICATION RELATING TO PRIORITY CLAIM

(PCT Rules 26bis.1 and 26bis.2 and
Administrative Instructions, Sections 402 and 409)

To:

FRENCH, David, J.
P.O. Box 2486, Stn. D
Ottawa, Ontario K1P 5W6
CANADA

Date of mailing (day/month/year) 30 October 2000 (30.10.00)	IMPORTANT NOTIFICATION
Applicant's or agent's file reference CORDL-02.PCT 5041-02	
International application No. PCT/CA00/00981	International filing date (day/month/year) 25 August 2000 (25.08.00)
Applicant CORDLESS ANTISTATIC RESEARCH INC. et al	

The applicant is hereby **notified** of the following in respect of the priority claim(s) made in the international application.

1. ☒ **Correction of priority claim.** In accordance with the applicant's notice received on: 10 October 2000 (10.10.00), the following priority claim has been corrected to read as follows:
CA 26 August 1999 (26.08.99) 2,280,996
☐ even though the indication of the number of the earlier application is missing.
☐ even though the following indication in the priority claim is not the same as the corresponding indication appearing in the priority document:
2. ☐ **Addition of priority claim.** In accordance with the applicant's notice received on: , the following priority claim has been added:
☐ even though the indication of the number of the earlier application is missing.
☐ even though the following indication in the priority claim is not the same as the corresponding indication appearing in the priority document:
3. ☐ As a result of the correction and/or addition of (a) priority claim(s) under items 1 and/or 2, the (earliest) priority date is:
4. ☐ **Priority claim considered not to have been made.**
☐ The applicant failed to respond to the Invitation under Rule 26bis.2(a) (Form PCT/IB/316) within the prescribed time limit.
☐ The applicant's notice was received after the expiration of the prescribed time limit under Rule 26bis.1(a).
☐ The applicant's notice failed to correct the priority claim so as to comply with the requirements of Rule 4.10.
The applicant may, before the technical preparations for international publication have been completed and subject to the payment of a fee, request the International Bureau to publish, together with the international application, information concerning the priority claim. See Rule 26bis.2(c) and the PCT Applicant's Guide, Volume I, Annex B2(II).
5. ☐ In case where **multiple priorities** have been claimed, the above item(s) relate to the following priority claim(s):
6. A copy of this notification has been sent to the receiving Office and
☒ to the International Searching Authority (where the international search report has not yet been issued).
☒ the designated Offices (which have already been notified of the receipt of the record copy).

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland	Authorized officer J. Leitao
Facsimile No. (41-22) 740.14.35	Telephone No. (41-22) 338.83.38

PATENT COOPERATION TREATY

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Commissioner
 US Department of Commerce
 United States Patent and Trademark
 Office, PCT
 2011 South Clark Place Room
 CP2/5C24
 Arlington, VA 22202
 ETATS-UNIS D'AMERIQUE
 in its capacity as elected Office

Date of mailing (day/month/year) 05 June 2001 (05.06.01)	
International application No. PCT/CA00/00981	Applicant's or agent's file reference CORDL-02.PCT 5041-02
International filing date (day/month/year) 25 August 2000 (25.08.00)	Priority date (day/month/year) 26 August 1999 (26.08.99)
Applicant BRUN DEL RE, Riccardo et al	

1. The designated Office is hereby notified of its election made:



in the demand filed with the International Preliminary Examining Authority on:

16 March 2001 (16.03.01)



in a notice effecting later election filed with the International Bureau on:

2. The election ☒ was

was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO
 34, chemin des Colombettes
 1211 Geneva 20, Switzerland

Facsimile No.: (41-22) 740.14.35

Authorized officer

Charlotte ENGER

Telephone No.: (41-22) 338.83.38


PCT

REC'D 07 DEC 2001

WIPO PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference CORDL-02.PCT 5041-02		FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/CA00/00981	International filing date (day/month/year) 25/08/2000	Priority date (day/month/year) 26/08/1999	
International Patent Classification (IPC) or national classification and IPC A61B5/0408			
Applicant CORDLESS ANTISTATIC RESEARCH INC. et al.			
<p>1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 5 sheets, including this cover sheet.</p> <p><input checked="" type="checkbox"/> This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).</p> <p>These annexes consist of a total of 6 sheets.</p>			
<p>3. This report contains indications relating to the following items:</p> <ul style="list-style-type: none"> I <input checked="" type="checkbox"/> Basis of the report II <input type="checkbox"/> Priority III <input type="checkbox"/> Non-establishment of opinion with regard to novelty, inventive step and industrial applicability IV <input type="checkbox"/> Lack of unity of invention V <input checked="" type="checkbox"/> Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement VI <input type="checkbox"/> Certain documents cited VII <input type="checkbox"/> Certain defects in the international application VIII <input type="checkbox"/> Certain observations on the international application 			
Date of submission of the demand 16/03/2001		Date of completion of this report 05.12.2001	
Name and mailing address of the international preliminary examining authority:  European Patent Office - Gitschiner Str. 103 D-10958 Berlin Tel. +49 30 25901 - 0 Fax: +49 30 25901 - 840		Authorized officer Jonsson, P.O. Telephone No. +49 30 25901 640	



INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/CA00/00981

I. Basis of the report

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):

Description, pages:

1-28 as originally filed

Claims, No.:

1-21 as received on 24/09/2001 with letter of 24/09/2001

Drawings, sheets:

1/11-11/11 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. PCT/CA00/00981

☐ the drawings, sheets:

5. ☒ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

see separate sheet

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims
	No:	Claims 1,3-11,13-16
Inventive step (IS)	Yes:	Claims
	No:	Claims 1,3-11,13-16
Industrial applicability (IA)	Yes:	Claims
	No:	Claims 1,3-11,13-16

- 2. Citations and explanations**
see separate sheet

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/CA00/00981

Reference is made to the following documents:

D1: US-A-3 882 846 (FLETCHER JAMES ET AL) 13 May 1975 (1975-05-13);

D2: US-A-4 602 639 (HOOGENDOORN DIRK ET AL) 29 July 1986 (1986-07-29).

Re Item I

Basis of the report

The amendments filed with the letter dated 24.9.2001 introduce subject-matter which extends beyond the content of the application as filed, contrary to Article 34(2)(b) PCT. The amendments concerned are the following:

Claims 2 and 21:

There is no mention of a limitation to "unmodulated voltage output" in the application as originally filed.

Claim 12:

There is no support for an additional conductive element on the side of the face surface of the pick-up electrode. On the contrary there is an additional conductive element on all other sides but the face surface, see figure 4 and page 25, lines 10-21 of the application as originally filed.

Claims 17-21:

"No greater than 50%" corresponds to ≤ 50 , whereas it was originally disclosed in claim 17 "less than 50 %", which corresponds to < 50 . Since claims 18-21 are dependent from claim 17 they also contain subject-matter which extends beyond the content of the application as filed.

Re Item V

Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

Document **D2**, which is considered to represent the most relevant state of the art, discloses (cf. col. 1, line 65- col. 2, line 28) an electric potential sensor from which the subject-matter of claim 1 differs only in that it gives a specific value of the change in

capacitance with distance.

The problem to be solved by the present invention may therefore be regarded as how to use the probe in **D2** in a region where the change in capacitance varies insensitively with displacement of the probe.

The solution proposed in claim 1 of the present application cannot be considered as involving an inventive step (Article 33(3) PCT) for the following reason:

The feature of having a change in capacitance of 50% when subjected to a 0.1 mm increase is merely one of several straightforward possibilities from which the skilled person would select, in accordance with circumstances, without the exercise of inventive skill, in order to solve the problem posed. Thus, the subject-matter of claim 1 does not involve an inventive step and does not satisfy the criterion set forth in Article 33(3) PCT.

The remaining dependent claims 3-11, 13-16 do not contain any features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT in respect of novelty and/or inventive step.

NOTE:

D2 appears to be aimed at determining the electric potential of entire body parts, like an arm, at very large distances (10 cm), see **D2**, figure 6 and col. 5, lines 9-17. Although **D2** mentions ECG and EEG sensors of conventional type (see for instance **D1**) It would appear from **D2** col. 1, lines 52-60 that it is unsuitable for application in non-contact ECG or EEG sensors, where completely different distances are used (typically 0.1-1 cm). **D2** would therefore not be anticipating novelty or inventive step for an ECG/EEG electric potential sensor.

REPLACED BY
APT 34 AMDT

THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE
PROPERTY ARE CLAIMED AS FOLLOWS:

1. An electric field sensor for detecting an electric
field present over a surface comprising:

5 (1) a voltage divider network including at one end a
pick-up electrode with a face surface having an
insulating layer positioned adjacent to said face
surface for placement next to a source surface
whose electrical field is to be sensed through
10 capacitive coupling, the voltage divider network
including at another end an electrical coupling for
connection to another portion of the source surface
over which an electrical potential difference
exists; and

15 (2) signal sensing means having an input capacitance
that forms a portion of the voltage divider
network, the signal sensing means being connected
for measuring the voltage appearing across that
portion of the voltage divider network provided by
20 the input capacitance of the signal sensing means,
characterized in that the capacitance existing between the
source surface and the signal sensing means is sufficient so
that, when the pickup electrode is placed adjacent the source
surface whose field is to be measured, the change in the
25 capacitive coupling between the signal sensing means and the
source surface arising from a change in the separation
distance between the pickup electrode and said surface varies
insensitively with displacement of the electrode towards or
away from the surface, thereby permitting effective detection
30 of said electric field without placing the face surface of the

pick-up electrode in intimate contact with the source surface.

2. A sensor as in claim 1 wherein the overall, effective capacitance that may be formed between said source surface and the signal sensing means through the pick-up electrode has a value in the region of a plot of capacitance value versus separation distance wherein the percentage change in capacitance is less than 50 percent when subjected to a 0.1 mm change in the separation distance occurring between the pick-up electrode and the confronted surface.
- 10 3. A sensor as in claim 2 wherein the percentage change in capacitance is less than 20% when a 0.1 mm change in the separation distance occurs.
4. A sensor as in claim 1 wherein said insulating layer is of such dimensions as to preclude the electrode from providing a capacitance value of over 40 picoFarads/cm².
- 15 5. A sensor as in claim 1 wherein said insulating layer is of such dimensions as to preclude the electrode from providing a capacitance value of over 20 picoFarads/cm².
- 20 6. A sensor as in claim 1 wherein said insulating layer is of such dimensions as to preclude the electrode from providing a capacitance value of over 10 picoFarads/cm².
7. An electric field sensor for detecting an electric field present over a surface comprising:
- 25 (1) a voltage divider network including at one end a pick-up electrode with a face surface having an insulating dielectric layer positioned adjacent to

said face surface for placement next to a source surface whose electrical field is to be sensed through capacitive coupling, the voltage divider network including at another end an electrical coupling for connection to another portion of the source surface over which an electrical potential difference exists;

(2) signal sensing means having an input capacitance that forms a portion of the voltage divider network, the signal sensing means being connected for measuring the voltage appearing across that portion of the voltage divider network provided by the input capacitance of the signal sensing means; and

(3) a series capacitor, positioned within said voltage divider network between said pickup electrode and the signal sensing means, said series capacitor having a value in picoFarads of less than five times the area of the pickup electrode in cm^2 .

8. A sensor as in claim 7 wherein said series capacitor has a value of at between 5 and 40 picoFarads.

9. A sensor as in claim 4 comprising a leakage resistor in parallel with the input capacitance of the signal sensing means of between 10^{11} and 10^{13} ohms.

10. A sensor as in claim 1 comprising a capacitive coupling to the surface at the end of the voltage divider network opposite the pick-up electrode.

11. A sensor as in claim 1 comprising a resistive-contact coupling to the surface at the end of the voltage divider network opposite the pick-up electrode, said resistive contact coupling having a resistance value of 500 k ohms, or
5 less.
12. A sensor as in claim 1 having a conductive element positioned over the externally-directed side of the sensor to exclude the effects of externally generated electromagnetic signals.
- 10 13. A sensor assembly system comprising two pick-up sensors as in claim 1 applied at a spaced separation over the surface and connected to a differential amplifier to obtain the difference in the output signals from two locations on the surface with common mode noise rejection.
- 15 14. A sensor assembly comprising multiple sensors each as in claim 1 assembled on a carrier to locate the pick-up electrodes of each sensor in a fixed, preformatted array.
15. A sensor assembly as in claim 14 wherein the carrier is a piece of clothing that can be readily donned or removed
20 with minimal inconvenience.
16. A sensor assembly as in claim 14 combined with tele-monitoring means.
17. A method of sensing an electric field present over a surface comprising:
- 25 (1) presenting a pickup electrode to confront said surface and to establish a capacitive coupling to

said surface and receive a signal based upon the electric field emanating therefrom;

(2) applying the signal so received to a voltage divider network which includes at one end the pick-up electrode and at another end an electrical coupling means connected to another portion of the surface over which an electrical potential difference exists, there being a high impedance amplifier with an input capacitance connected there between;

(3) maintaining the pickup electrode at a spaced separation from the confronted, field-emanating surface so that the overall effective capacitance between said surface and said amplifier has a value in the region of a plot of capacitance value versus separation distance wherein the percentage change in capacitance is less than 50 percent when subjected to a 0.1 mm change in the separation distance occurring between the pick-up electrode and the confronted surface

whereby a signal is provided to the amplifier and the capacitive coupling between the field-emanating surface and the pickup electrode varies insensitively with displacement of the electrode towards or away from said surface.

18. A method as in claim 17 wherein the percentage change in the capacitance is less than 20% when a 0.1 mm change in the separation distance occurs.

19. A method as in claim 17 wherein the pickup electrode has a surface confronting face that is provided with an insulative dielectric layer having a thickness such as to

preclude the electrode from providing a capacitance value of over 40 picoFarads per centimeter squared.

20. A method as in claim 17 wherein the voltage divider network includes a series limiting capacitor between the pickup electrode and the input to the amplifier, the pickup electrode having a value of between 5 and 40 picoFarads.